RQ-4A Global Hawk Unmanned Aerial Vehicle (UAV)

The Global Hawk Unmanned Aerial Vehicle (UAV) system is a theater commander's asset designed to satisfy surveillance and reconnaissance shortfalls. The Global Hawk air vehicle is to provide high-resolution Synthetic Aperture Radar (SAR) and Electro-Optical/Infrared (EO/IR) imagery at long range with long loiter times over target areas. A Signals Intelligence (SIGINT) capability is also being developed. Potential missions for the Global Hawk cover the spectrum of intelligence collection capabilities to support joint combatant forces in worldwide peace, crisis, and wartime operations.

The Global Hawk UAV system is comprised of an air vehicle component with air vehicles, sensor payloads, avionics, and data links; a ground segment with a launch and recovery element (LRE); a mission control element (MCE) with embedded ground communications equipment; a support element; and trained personnel.

The Global Hawk air vehicle is optimized for high-altitude, long range, and endurance; it is to be capable of providing 28 hours endurance while carrying 3,000 pounds of payload and operating above 60,000 feet mean sea level. The integrated sensor suite contains SAR, EO, and IR sensors. Each of the sensors provides wide area search imagery and a high-resolution spot mode. The radar also has a ground moving target indicator mode. A limited initial SIGINT capability will be incorporated prior to the Initial Operational Test and Evaluation (IOT&E) in FY06 while a more capable system in development will be integrated in production aircraft in the years that follow. Global Hawk is intended to operate autonomously using a satellite data link (either Ku or UHF) for sending sensor data from the aircraft to the MCE. The common data link can also be used for direct down link of imagery when the UAV is operating within line-of-sight of users with compatible ground stations.

The ground segment consists of the MCE for mission planning, command and control, and image processing and dissemination; the LRE for controlling launch and recovery; and associated ground support equipment. By having separable elements in the ground segment, the MCE and the LRE can operate in geographically separate locations, and the MCE can be deployed with the supported command's primary exploitation site. Both ground segments are contained in military shelters with external antennas for line of sight and satellite communications with the air vehicles.

The Global Hawk program began as part of the High Altitude Endurance Advanced Concept Technology Demonstration (ACTD) in 1995 under Defense Advanced Research Projects Agency management. At the conclusion of the ACTD, United States Joint Forces Command declared the Global Hawk had military utility and submitted a military utility assessment in September 2000 to support the transition from an ACTD to an acquisition program. Early operational assessments produced by the Air Force Operational Test and Evaluation Command and DOT&E found the system potentially effective and potentially suitable.

The Milestone II decision in March 2001 approved entry into engineering and manufacturing development as well as low-rate initial production (LRIP) of six air vehicles, two MCEs, and two LREs. Prior to that decision, DOT&E approved the Test and Evaluation Master Plan (TEMP), asking for an update within 120 days of the contract award. Since March 2001, the program has been accelerated

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and re-baselined. At a meeting of the Defense Acquisition Board (DAB) in March 2002, the Air Force presented an accelerated program that produces a multi-INT (EO/IR/SAR/SIGINT) system through a spiral development program consisting of at least 4 spirals. The Defense Acquisition Executive approved spiral 1 and 2 development as well as the production of 17 LRIP air vehicles, 4 ground segments, and advanced procurement for the FY06 Full-Rate Production buy. In response to OSD direction, an updated Operational Requirements Document (ORD) to reflect the new program was approved by the Joint Requirements Oversight Council on October 29, 2002.

The DAB met in December 2002 and approved development of spirals 3 and 4, which include integration of the full SIGINT capability and the Multiplatform Radar Technology Insertion Program payload, and an increase of LRIP from 17 to 19 air vehicles. The DAB also approved program changes proposed by the Air Force to improve affordability, including the dedication of 12 of the 51 total aircraft to carry only the MP-RTIP sensor.

The Air Force has identified Global Hawk as a "Pathfinder Program" for an acquisition streamlining effort intended to field key capabilities to the warfighter as quickly as possible using spiral development. This effort intends to improve both the requirements generation process and the combined Development Test/Operational Testing process. The proposed TEMP ties specific ORD requirements to the test phases where they will be tested.

TEST & EVALUATION ACTIVITY

Three Global Hawk air vehicles and ground elements were deployed in October 2001 to support operations in Afghanistan. One air vehicle crashed December 30, 2001, because of an assembly defect, while a second one crashed July 10, 2002, due to suspected engine failure. Of the five Global Hawk air vehicles built during the ACTD, two are available. A sixth aircraft, procured as one of two at the end of the ACTD but prior to the LRIP, made its first flight April 22, 2002.

There has been limited formal test and evaluation activity this year. Following the April-May 2001 deployment to Australia, flight-testing conducted at Edwards Air Force Base included brake tests, cross-wind limitation testing, and the first replace on station (ROS) testing. Since October 2001, flight testing at Edwards has been limited to supporting operations in Afghanistan through activities such as check flights of new software builds. Functional check flights of air vehicle 6 and calibration of a new sensor suite that was delivered in February 2002 were also performed. Electromagnetic Interference and Compatibility (EMI/EMC) ground testing was conducted at Edwards Air Force Base in June 2002 to baseline the aircraft for SIGINT development and integration. Testing was slowed by necessary down-time following the two air vehicle crashes. The Air Force Operational Test and Evaluation Command has collected data on deployed operations and produced a classified report on Global Hawk performance during participation in Operation Enduring Freedom (OEF).

A TEMP is in coordination to address changes in operational requirements and acquisition strategy. A detailed test plan is expected to cover the period leading up to IOT&E in FY06. Air vehicle 7, which will be the primary aircraft for development and operational testing during Developmental Test/Operational Testing, is expected to begin productive flight test at Edwards in January 2003.

TEST & EVALUATION ASSESSMENT

The ACTD ended with a number of areas where improvement was needed or performance was not known. The DOT&E Early Operational Assessment (EOA) noted mission planning, imagery dissemination, scene accountability, system re-tasking, and communication bandwidth burden as areas where improvement would be necessary for an operationally effective system. Average National Imagery Interpretation Rating Scale rating of SAR imagery was also found to be below specifications. The EOA found that reliability and spare parts availability must be improved as well as a logistics infrastructure and maintenance concept would be necessary for an operationally suitable system.

There were many areas where data were lacking at the end of the ACTD. In particular, neither the EO/IR nor the radar's ground moving target indicator mode was examined in depth. EO/IR development has been further hampered by the loss of the only four EO/IR sensors in air vehicle mishaps.

Since the ACTD, the only periods where data were collected under operational conditions was during an Australian

demonstration in April 2001 and during support for OEF. The data from Australia is limited by the use of non-representative tactics and experimental software. (The Australian Defence Force funded the development of experimental maritime modes for the radar.) Details of support for OEF to the extent they are known are classified and are not included here.

Problems similar to the ACTD experience were seen in Australia, including lengthy mission planning, lack of user friendly re-tasking capability, and lower than expected reliability (largely driven by frequent sensor "crashes" and problems with imagery processing and storage software in the ground station). Lack of spare parts, training, and technical data were again noted as programmatic voids. A joint Australian/U.S. report also noted lower than expected imagery quality from the EO/IR sensor based on preliminary analysis by Australian image analysts.

The Air Force Operational Test and Evaluation Command's OEF report is classified. The report, however, notes contributions of the system through making a large volume of imagery available to the theater intelligence architecture and provides anecdotal evidence of Global Hawk positively affecting decisions. Two air vehicles were lost during the deployment and suitability issues similar to those seen in previous testing were noted.

The report on the first developmental ROS testing, accelerated because of OEF, found the ability of the system to conduct ROS marginal, noting unsatisfactory voice communications and controls and displays. EMI testing provided a baseline EMI profile. Performance was found satisfactory although some mitigation may be required depending on operational requirements.

The applicability of this data to production systems is limited, however. By the time the first IOT&E is expected to occur in FY06, much of the system will have changed. The system will have an entirely new EO/IR sensor and the radar will have completely new software, along with increased power and associated changes in hardware. Modifications are also planned to increase endurance, including re-winging the aircraft. A SIGINT package is being added and, to accommodate the increased weight of the payload, structural changes are also being made. Many of these changes, however, will not occur until after the operational assessment, limiting DOT&E's ability to draw conclusions on these new capabilities in support of the In-Process Review following the FY04 Operational Assessment.

Demands on development and test resources are extreme in the Global Hawk program. The program has lost three air vehicles and cannibalization has left another unflyable. The first four EO/IR sensors delivered have also been lost. The situation is exacerbated by participation in demonstrations. Not only do the demonstrations demand assets such as air vehicles, they also require the development of unique capabilities to support those efforts. In addition to the 2001 Australian deployment, a congressionally-directed United States Southern Command demonstration planned for February 2003 and a German demonstration planned for April 2003 require the development of capabilities such as maritime radar modes, an air-to-air moving target indicator, and a European Aeronautic Defence and Space electronic intelligence sensor. In addition to pulling test assets, these demonstrations put the system in non-representative configurations and limit applicability of any ancillary data collected.

Spiral development creates a dynamic operational test and evaluation environment. DOT&E is working with the program office to ensure that the program complies with "fly-before-buy" philosophy and practices.